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U.S. Patent Application No. 10/001,709

Title of the Invention:

POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY USING
THE SAME

I, Kyoko HIRANO, whose full post office address is IKEUCHI・ SATO &
PARTNER PATENT ATTORNEYS, 26th Floor, OAP TOWER, 8-30,
Tenmabashi 1-Chome, Kita-ku, Osaka-Shi, OSAKA 530-6026, JAPAN

am the translator of the document attached and I state that the following is
a true translation to the best of my knowledge and belief of Japanese Patent
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At Osaka, Japan
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Signature of the translator

Kyoko Hirano

Kyoko HIRANO

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This is to certify that the annexed is a true copy of the following application as filed with this Office.

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[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Yuji SAIKI

[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Senri YOSHIKAWA

[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Youichirou SUGINO

[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Seiichi KUSUMOTO

[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Eiji HAMAMOTO

[Inventor]

[Address] c/o Nitto Denko Corporation

1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, JAPAN

[Name] Takashi SHOUDA

[Patent Applicant]

[Identification Number] 000003964

[Name of Company] Nitto Denko Corporation

[Attorney]

[Identification Number] 100095555

[Patent Attorney]

[Name] Hiroyuki IKEUCHI

[Telephone number] 06-6361-9334

[Appointed Attorney]

[Identification Number] 100076576

[Patent Attorney]

[Name] Kimihiro SATO

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[DOCUMENT NAME] SPECIFICATION

[TITLE OF THE INVENTION] POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY USING THE SAME

[CLAIMS]

- 5 [Claim 1] A polarizing plate comprising a polarizer, the polarizer comprising: a first portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 420 to 550 nm, and a second portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 550 to 700 nm, wherein the first portion and the second
10 portion are laminated.
- [Claim 2] The polarizing plate according to claim 1, further comprising a reflector or a transreflector attached to the polarizing plate.
- [Claim 3] The polarizing plate according to claim 1, further comprising a retardation plate or a λ plate attached to the polarizing plate.
- 15 [Claim 4] The polarizing plate according to claim 1, further comprising a viewing angle compensating film attached to the polarizing plate.
- [Claim 5] The polarizing plate according to claim 1, further comprising a brightness-enhanced film attached to the polarizing plate.
- [Claim 6] A liquid crystal display using a polarizing plate according to any
20 one of claims 1 to 5 on at least one side of a liquid crystal cell.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical field to which the invention pertains]

The present invention relates to a polarizing plate used for a liquid
25 crystal display (LCD) and a liquid crystal display using such a polarizing plate.

[0002]

[Prior Art]

Recently, demand for LCDs used for, for example, personal computers
30 has increased sharply. Application for LCDs has also broadened. Recently, such LCDs are used for monitoring as well.

[0003]

A polarizing plate used for a LCD is manufactured, for example, by a method including steps of: dyeing a polyvinyl alcohol (PVA) film with dichroic
35 iodine or a dichroic dyestuff; crosslinking the film with boric acid, borax, or the like; stretching the film uniaxially, followed by drying the film and sticking it to a protective layer such as a triacetylcellulose (TAC) film. The

respective steps of dyeing, crosslinking and stretching are not necessarily carried out separately and can be carried out simultaneously. Furthermore, there is no limitation on the order of the steps.

[0004]

- 5 [Problem to be solved by the invention]

In recent years, as LCDs are used for high performance equipment such as for monitoring, the hue of a polarizing plate has a large effect on the hue of a liquid crystal display.

[0005]

- 10 However, since the polarizing plate has low polarizing performance in a short-wavelength region or a long wavelength region in the wavelength of the visible region, if polarization performance in a short wavelength region is enhanced, polarization performance in a long wavelength region lowers. To the contrary, if polarization performance in a long wavelength region is
15 enhanced, polarization performance in a short wavelength region lowers. Accordingly, it has been difficult to achieve excellent polarization performance in all wavebands from a short wavelength region to a long wavelength region. As a result, there arises a problem that the hue of the liquid crystal display becomes bad.

20 [0006]

In one aspect, the present invention relates to a polarizing plate capable of obtaining excellent polarization performance in all wavebands from a short wavelength region to a long wavelength region and a liquid crystal display using such a polarizing plate.

25 [0007]

[Means for solving problem]

- 30 In one aspect of the present invention, a polarizing plate of the present invention includes a polarizer including a first portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 420 to 550 nm, and a second portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 550 to 700 nm, wherein the first portion and the second portion are laminated.

[0008]

- 35 Thus, it is possible to obtain a polarizing plate having excellent polarization performance in all wavebands from a short wavelength region to a long wavelength region.

[0009]

Furthermore, it is preferable that the polarization plate of the present invention further includes a reflector or a transreflector attached thereto.

[0010]

Furthermore, it is preferable that the polarization plate of the present invention further includes a retardation plate or a λ plate attached thereto.

[0011]

Furthermore, it is preferable that the polarization plate of the present invention further includes a viewing angle compensating film attached thereto.

10 [0012]

Furthermore, it is preferable that the polarization plate of the present invention further includes a brightness-enhanced film attached thereto.

[0013]

In another aspect, the present invention relates to a liquid crystal display including a liquid crystal cell and the above mentioned polarizing plate, wherein the polarizing plate is used on at least one side of the crystal cell.

[0014]

[DESCRIPTION OF THE PREFERRED EMBODIMENTS]

20 The present invention provides a polarizing plate having excellent polarization performance in all wavebands from a short wavelength region to a long wavelength region by using a polarizer having a portion with high polarization performance in a short wavelength region and a portion with high polarization performance in a long wavelength region and provides a 25 liquid crystal display using such a polarizing plate.

[0015]

In other words, it is confirmed that by using a polarizer in which a portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 420 to 550 nm and a portion having a polarization 30 degree of 99% or more at each wavelength of light for wavelengths of 550 to 700 nm are laminated, the polarizing plate having excellent polarization performance in all wavebands from a short wavelength region to a long wavelength region can be obtained.

[0016]

35 The polarization degree is calculated from the following equation (Formula 1). In Formula 1, A denotes a parallel transmittance (transmittance when the polarizing axes of two polarizing plates are placed in

parallel to each other) and B denotes an orthogonal transmittance (transmittance when the polarizing axes of two polarizing plates are placed orthogonal to each other).

[0017]

$$5 \quad \text{polarization degree} = \sqrt{\frac{A-B}{A+B}} \times 100$$

(Formula 1)

[0018]

In a basic configuration of the polarizing plate used in the present invention, a transparent protective film as a protective layer is adhered to one side or both sides of the polarizer made of a polyvinyl alcohol-based polarizing film containing dichroic substance, and the like, via an appropriate adhesive layer, for example, a layer of adhesive made of, for example, a vinyl alcohol-based polymer.

[0019]

15 A polarizer (polarizing film) made of an appropriate polyvinyl alcohol polymer film that are known in the art, for example, polyvinyl alcohol film, a partially formalized polyvinyl alcohol film, or the like, is subjected to appropriate treatment such as dyeing with dichroic substances such as iodine and a dichroic dyestuff, stretching, crosslinking into any suitable orders.

20 Any polarizer can be used, as long as it allows linearly polarized light to pass through the film when natural light enters. In particular, a polarizer with an excellent light transmittance and a polarization degree is preferred.

[0020]

25 As a material for the protective film forming a transparent protective layer provided on one side or both sides of the polarizer (polarizing film), an appropriate transparent film can be used. As the polymer, for example, an acetate-based resin such as triacetylcellulose is generally used. However, the polymer is not necessarily limited thereto.

[0021]

30 When some factors such as polarizing property and durability are taken into consideration, preferred transparent protective film is a triacetylcellulose film having a surface saponified with alkali or the like. When transparent protective films are provided on both sides of the polarizing film, one polymer transparent protective film may be used on the front side and another polymer transparent protective film may be used on the backside.

[0022]

The transparent protective film used for the protective layer may be subject to treatment for providing properties such as hard coating, antireflection, anti-sticking, dispersion, or anti-glaring, as long as the 5 advantages of the present invention are not lost. Hard coating treatment is carried out to prevent scratches on the surfaces of the polarizing plate by, for example, applying a surface of the transparent protective film with a coating film of a hardening resin (e.g., a silicon-based ultraviolet hardening resin) having excellent hardness and smoothness, etc.

10 [0023]

On the other hand, antireflection treatment is carried out to prevent reflection of outdoor daylight on the surface of the polarizing plate by, for example, forming an anti-reflection film in a conventional manner. Furthermore, anti-sticking treatment is carried out to prevent adjacent 15 layers from sticking to each other. Anti-glaring treatment is carried out to prevent visibility of light passing through the polarizing plate from being hindered by outdoor daylight reflected on the surface of the polarizing plate. The anti-glaring treatment can be carried out by providing microscopic asperities on a surface of a transparent protective film in an appropriate 20 manner, for example, by roughening the surface by sand-blasting or embossing, by blending transparent particles, or the like.

[0024]

An example of the above-mentioned transparent fine particles includes silica, alumina, titania, zirconia, stannic oxide, indium oxide, 25 cadmium oxide, antimony oxide or the like, which have an average particle diameter ranging from 0.5 μm to 20 μm . Inorganic fine particles having electroconductivity may also be used. Alternatively, organic fine particles including, for example, crosslinked or uncrosslinked polymer particles, etc. can be used. The amount of the transparent fine particles ranges generally 30 from 2 parts by weight to 70 parts by weight, and particularly from 5 parts by weight to 50 parts by weight for 100 parts by weight of the transparent resin.

[0025]

An anti-glare layer including transparent fine particles can be provided as the transparent protective layer or a coating layer applied onto 35 the surface of the transparent protective layer. The anti-glare layer may have a function as a diffusion layer to diffuse light passing through the polarizing plate in order to enlarge viewing angle (this function is referred to

as a viewing angle compensating function). The above-mentioned layers such as the antireflection layer, the anti-sticking layer, the diffusion layer, and the anti-glare layer can be provided separately from the transparent protective layer as an optical layer, for example, in sheet form including the
5 above-mentioned layers.

[0026]

There is no specific limitation on treatment for adhering the polarizer (polarizing film) to the transparent protective film that is a protective layer. Adhesion can be carried out, for example, by using an adhesive such as an
10 adhesive including a vinyl alcohol-based polymer, or an adhesive including at least a water-soluble crosslinking agent of vinyl alcohol-based polymer such as boric acid, borax, glutaraldehyde, melamine and oxalic acid. A layer of such an adhesive can be formed by, for example, applying and drying an aqueous solution. In preparation of the aqueous solution, other additives, a
15 catalyst such as an acid can be blended if necessary.

[0027]

In a practical use, a polarizer can be used as an optical member that is laminated onto other optical layer. Though there is no specific limitation on the optical layer, one or two or more of appropriate optical layer(s)
20 applicable for formation of a liquid crystal display, etc. can be used. An example of the optical layer includes, for example, a reflector, a transreflector, a retardation plate (such as a λ plate like a half wavelength plate and a quarter wavelength plate), a viewing angle compensating film, a brightness-enhanced film, and the like. A specifically preferable example of
25 the polarizing plate includes a reflective polarizing plate or a semitransparent polarizing plate formed by laminating an additional reflector or a transreflector on the above-mentioned polarizing plate including a polarizer and a protective layer according to the present invention; an elliptical polarizing plate or a circular polarizing plate formed by laminating
30 an additional retardation plate on the above-mentioned polarizing plate including a polarizer and a protective layer; a polarizing plate formed by laminating an additional viewing angle compensating film on the above-mentioned polarizing plate including a polarizer and a protective layer; or a polarizing plate formed by laminating an additional brightness-enhanced
35 film on the above-mentioned polarizing plate including a polarizer and a protective layer.

[0028]

A reflector is provided on a polarizing plate in order to form a reflective polarizing plate. In general, such a reflective polarizing plate is provided on the backside of a liquid crystal cell in order to make a liquid crystal display, etc. to display by reflecting incident light from a visible side (display side). The reflective polarizing plate has some advantages, for example, light sources such as backlight need not be built in, and thus the liquid crystal display can be thinned further.

[0029]

The reflective polarizing plate can be formed in an appropriate manner such as attaching a reflecting layer made of, for example, metal on one surface of the polarizing plate via, for example, the above-mentioned transparent protective film as required. As a specific example, a reflecting layer formed by attaching a foil of a reflective metal such as aluminum or a deposition film on one surface of the transparent protective film that has been subjected to matting treatment as required.

[0030]

An additional example of a reflective polarizing plate includes the above-mentioned transparent protective film having a surface of microscopic asperities due to fine particles contained and a reflecting layer corresponding to the microscopic asperities. The reflecting layer having a surface with microscopic asperities diffuses incident light irregularly, so that directivity and glare can be prevented and irregularity in color tones can be controlled. This transparent protective film can be formed by attaching a metal directly onto a surface of a transparent protective film in any appropriate methods including deposition such as vacuum deposition, and plating such as ion plating and sputtering.

[0031]

Alternatively, the reflector can be used as, for example, a reflecting sheet formed by providing a reflecting layer onto an appropriate film similar to the transparent protective film, instead of the above-mentioned method of producing a reflector directly on the transparent protective film of the polarizing plate. The reflecting layer of the reflector, which generally is made of metal, is preferably used with its surface covered with a film, a polarizing plate or the like, because the reduction of reflectance due to oxidation can be prevented, the initial reflectance can be maintained for a long time, an additional protective layer need not be formed, or the like.

[0032]

A semitransparent polarizing plate can be obtained in the same method for forming the reflective polarizing plate except that a semitransparent reflecting layer such as a half mirror, which reflects light and transmits light on the reflecting layer, is used instead of using the reflecting layer. In general, the semitransparent polarizing plate is provided on the backside of a liquid crystal cell. When a liquid crystal display is used in a relatively bright atmosphere, the semitransparent polarizing plate allows an incident light from the visible side (display side) to be reflected to display an image, while in a relatively dark atmosphere, an image is displayed by using a built-in light source such as a backlight in the backside of the semitransparent polarizing plate. In other words, the semitransparent polarizing plate can be used to form a liquid crystal display that can save energy for a light source such as a backlight under a bright atmosphere, while a built-in light source can be used under a relatively dark atmosphere.

[0033]

Next, an elliptical polarizing plate or a circular polarizing plate in which a retardation plate is additionally laminated on the above-mentioned polarizing plate including a polarizer and a protective layer will be described.

[0034]

A retardation plate is used for modifying linearly polarized light to either elliptical polarized light or circular polarized light, modifying elliptical polarized light or circular polarized light to linearly polarized light, or modifying a polarization direction of linearly polarized light. In particular, a retardation plate called a quarter wavelength plate ($\lambda/4$ plate) is used for modifying linearly polarized light to circular polarized light, and for modifying circular polarized light to linearly polarized light. A half wavelength plate ($\lambda/2$ plate) is generally used for modifying a polarization direction of linearly polarized light.

[0035]

The elliptical polarizing plate is effective in compensating (preventing) colors (blue or yellow) generated due to birefringence in a liquid crystal layer of a super twist nematic (STN) liquid crystal display so as to provide a black-and-white display free from the above-mentioned colors. Controlling three-dimensional refractive index is further preferred since it can compensate (prevent) colors observed when looking a screen of the liquid crystal display from an oblique direction. A circular polarizing plate is

effective, for example, in adjusting color tones of an image of a reflective liquid crystal display that has a color image display, and it also serves to prevent reflection as well.

[0036]

5 An example of the retardation plate includes, for example, a birefringent film prepared by stretching an appropriate polymer film, an oriented film of a liquid crystal polymer, and an oriented layer of a liquid crystal polymer that is supported by a film, and the like. Examples of the polymer include, polycarbonate, polyvinyl alcohol, polystyrene, polymethyl
10 methacrylate, polyolefins such as polypropylene, polyalylate, and polyamide. Furthermore, the incline-oriented film is prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under an influence of shrinkage force by heat, or by orienting obliquely a liquid crystal polymer.

15 [0037]

Next, a polarizing plate in which a viewing angle compensating film is additionally laminated on the above-mentioned polarizing plate including a polarizer and a protective layer will be described.

[0038]

20 The viewing angle compensating film is used for widening a viewing angle so that an image can be seen relatively clearly even when a screen of a liquid crystal display is viewed from a slightly oblique direction.

[0039]

As the viewing angle compensating film, a triacetylcellulose film etc.
25 coated with a discotic liquid crystal, or a retardation plate are used. While an ordinary retardation plate is a birefringent polymer film that is stretched uniaxially in the face direction, a retardation plate used as the viewing angle compensating film is a two-way stretched film such as a birefringent polymer film stretched biaxially in the face direction, or an incline-oriented polymer
30 film with a controlled refractive index in the thickness direction that is stretched uniaxially in the face direction and stretched also in the thickness direction. The incline-oriented film is prepared by, for example, bonding a heat shrinkable film to a polymer film and subjecting the polymer film to stretching treatment and/or shrinking treatment under an influence of shrinkage force by heat, or by obliquely orienting a liquid crystal polymer. A
35 polymer as a material of the retardation plate is similar to the polymer used for the above-mentioned retardation plate.

[0040]

A polarizing plate in which a brightness-enhanced film is attached to the above-mentioned polarizing plate including a polarizer and a protective layer is generally arranged on the backside of a liquid crystal cell. When 5 natural light enters by the backlight of the liquid crystal display etc. and reflection from the backside and the like, the brightness-enhanced film reflects linearly polarized light of a predetermined polarizing axis or circularly polarized light in a predetermined direction, while transmitting other light. The polarizing plate in which the brightness-enhanced film is 10 laminated on the above-mentioned polarizing plate including a polarizer and a protective layer allows entrance of light from a light source such as a backlight to obtain transmitted light in a predetermined polarization state, while reflecting light other than light in the predetermined polarization state. Light reflecting by the brightness-enhanced film is reversed through a 15 reflecting layer or the like arranged additionally behind the brightness-enhanced film. The reversed light is allowed to re-enter the brightness-enhanced plate. The re-entering light is transmitted partly or entirely as light in a predetermined polarization state so as to increase the amount of light passing through the brightness-enhanced film and polarized 20 light that is hardly absorbed in the polarizer is supplied so as to increase the amount of light available for the liquid crystal display, etc. Thus, the brightness can be improved. That is to say, when light enters through a polarizer from the backside of the liquid crystal cell by using a backlight or the like without using any brightness-enhanced films, most of the light 25 having a polarization direction inconsistent with the polarization axis of the polarizer is absorbed in the polarizer but not transmitted by the polarizer. Depending on characteristics of the polarizer, about 50% of light is absorbed in the polarizer, which decreases the quantity of light available in the liquid crystal display or the like and makes the image dark. The 30 brightness-enhanced film repeatedly prevents light having a polarization direction to be absorbed in the polarizer from entering the polarizer to reflect the light on the brightness-enhanced film, and reverses the light through a reflecting layer or the like provided behind the brightness-enhanced film to make the light re-enter the brightness-enhanced plate. Since the 35 brightness-enhanced film transmits the polarized light that is reflected and reversed between the brightness-enhanced film and the reflecting layer only if the polarized light has a polarization direction to pass the polarizer, light

from a backlight or the like can be used efficiently for displaying images of a liquid crystal display in order to provide a bright screen.

[0041]

An example of the brightness-enhanced film includes, for example, a
5 film which transmits a linearly polarized light having a predetermined polarization axis and reflects other light, for example, a multilayer thin film of a dielectric or a multilayer laminate of thin films with varied refraction aeolotropy; a film that reflects either clockwise or counterclockwise circular polarized light while transmitting other light, for example, a cholesteric
10 liquid crystal layer, more specifically, an oriented film of a cholesteric liquid crystal polymer or an oriented liquid crystal layer supported on a supportive substrate, or the like.

[0042]

Therefore, with the brightness-enhanced film transmitting a linearly
15 polarized light having a predetermined polarization axis, the transmitted light directly enters the polarizing plate with the polarization axes matched, so that absorption loss due to the polarizing plate is controlled and the light can be transmitted efficiently. On the other hand, with the
brightness-enhanced film transmitting a circular polarized light, such as a
20 cholesteric liquid crystal layer, preferably, the transmission circular polarized light is converted to linearly polarized light before entering the polarizing plate in an aspect of controlling of the absorption loss, though the circular polarized light can enter the polarizer directly. Circular polarized light can be converted to linearly polarized light by using a quarter wavelength plate
25 as a retardation plate.

[0043]

A retardation plate having a function as a quarter wavelength plate in a wide wave range of a visible light region can be obtained, for example, by overlapping a retardation layer functioning as a quarter wavelength plate for
30 monochromatic light such as light having 550 nm wavelength and another retardation plate showing a separate optical retardation property, for example, a retardation plate functioning as a half wavelength plate. Therefore, a retardation plate arranged between a polarizing plate and a brightness-enhanced film can include a single layer or at least two layers of
35 retardation layers.

[0044]

A cholesteric liquid crystal layer also can be provided by combining

layers different in the reflection wavelength and it can be configured by overlapping two or at least three layers. As a result, the obtained retardation plate can reflect circular polarized light in a wide wavelength region of a visible light region, thus providing transmission circular polarized

5 light in a wide wavelength region.

[0045]

Alternatively, a polarizing plate can be formed by laminating a polarizing plate and two or at least three optical layers like the above-mentioned polarization separating type polarizing plate. In other words, the polarizing plate can be a reflective elliptical polarizing plate, a semitransparent elliptical polarizing plate or the like, which is prepared by combining the above-mentioned reflective polarizing plate or a semitransparent polarizing plate with a retardation plate. An optical member including a lamination of two or at least three optical layers can be formed in a method of laminating layers separately in a certain order for manufacturing a liquid crystal display etc. or in a method for preliminary lamination. Because an optical member that has been laminated previously has excellent stability in quality and assembling operability, efficiency in manufacturing a liquid crystal display can be improved. Any appropriate adhesion means such as an adhesive layer can be used for lamination.

[0046]

The adhesive layer can be provided on a polarizing plate or on an optical member for adhesion with other members such as a liquid crystal cell. The adhesive layer can be formed by the conventional appropriate adhesives such as an acrylic adhesive. Adhesives having a low moisture absorption coefficient and an excellent heat resistance is preferred from aspects of prevention of foaming or peeling caused by moisture absorption, prevention of decrease in the optical properties and warping of a liquid crystal cell caused by difference in thermal expansion coefficients, formation of a high quality liquid crystal display having excellent durability, etc. The adhesive layer can contain fine particles to obtain optical diffusivity. Adhesive layers can be provided on a necessary surfaces if required. For example, the polarizing plate including a polarizer and a protective layer can be provided with an adhesive layer on at least one surface of the protective layer as required.

35 [0047]

When an adhesive layer provided on the polarizing plate or the optical member is exposed on the surface, preferably, the adhesive layer is

temporarily covered with a separator for preventing contamination by the time the adhesive layer is used. The separator can be made of an appropriate thin sheet by coating a peeling agent if required, and an example of the peeling agent includes, for example, a silicone-based peeling agent, a long-chain alkyl-based peeling agent, a fluorine-based peeling agent, a peeling agent including molybdenum sulfide or the like.

- 5 [0048]

The above-described members forming a polarizing plate and an optical member, such as a polarizing film, a transparent protective film, an optical layer, and an adhesive layer can have ultraviolet absorption power by treating with an ultraviolet absorber such as, for example, an ester salicylate compound, a benzophenone compound, a benzotriazole compound, a cyanoacrylate compound, a nickel complex salt compound, and the like.

- [0049]

15 The above-mentioned polarizing plate can preferably be used for formation of various apparatus such as a liquid crystal display. The liquid crystal display can be produced as conventionally known structures, such as transmission type, reflection type, or a transmission-reflection type. A liquid crystal cell forming the liquid crystal display can be selected arbitrarily from 20 appropriate cells such as active matrix driving type represented by a thin film transistor, a simple matrix driving type represented by a twist nematic type and a super twist nematic type.

- [0050]

When polarizing plates or optical members are provided on both sides 25 of a liquid crystal cell, the polarizing plates or the optical members on both sides can be the same or different. Moreover, for forming a liquid crystal display, one or at least two layers of appropriate members such as a prism array sheet, a lens array sheet, an optical diffuser, or a backlight can be arranged at appropriate positions.

- 30 [0051]

[Example]

Hereinafter, the present invention will be described more specifically by referring to Examples and Comparative Examples.

- [0052]

- 35 (Example 1)

A polyvinyl alcohol film having a thickness of 75 µm was stretched to three times an original length in an aqueous solution dissolving potassium

iodide and iodine at the weight ratio of 7 : 1, and the film was further stretched in an aqueous solution containing 4 wt% of boric acid to have a total stretching ratio five times that of the original. Thereafter, the film was dried at 50°C for four minutes, and thus a polarizer 1 was obtained. The
5 polarization degree of the polarizer 1 at each wavelength of light for wavelengths of 550 to 700 nm was in a range of 99.7% to 100%.
[0053]

A polyvinyl alcohol film having a thickness of 75 µm was stretched to three times an original length in an aqueous solution containing potassium
10 iodide and iodine at the weight ratio of 7 : 1, and the film was further stretched in an aqueous solution containing 4 wt% of boric acid to have a total stretching ratio five times that of the original. Thereafter, the film was dipped in 10 wt% aqueous solution containing potassium iodide for 10 seconds and then the film was dried at 50°C for four minutes, and thus a
15 polarizer 2 was obtained. The polarization degree of the polarizer 2 at each wavelength of light for wavelengths of 420 to 550 nm was in a range of 99.1 to 99.9%.

[0054]

Next, the polarizer 1 and the polarizer 2 were attached to each other
20 so that the absorption axes thereof are parallel with each other and a polarizer of Example 1 was obtained.

[0055]

(Comparative Example 1)

A polyvinyl alcohol film having a thickness of 75 µm was stretched to three times an original length in an aqueous solution dissolving potassium
25 iodide and iodine at the weight ratio of 7 : 1, further stretched in an aqueous solution containing 4 wt% of boric acid to have a total stretching ratio five times that of the original, and then dipped in 4 wt% aqueous solution containing potassium iodide for five seconds and then the film was dried at
30 50°C for four minutes, and thus a polarizer of Comparative Example 1 was obtained. The polarization degree of the polarizer of Comparative Example 1 at each wavelength of light for wavelengths of 420 to 700 nm was in a range of 98.3 to 99.9%.

[0056]

35 (Comparative Example 2)

A polyvinyl alcohol film having a thickness of 75 µm was stretched to three times an original length in an aqueous solution dissolving potassium

iodide and iodine at the weight ratio of 7 : 1, further stretched in an aqueous solution containing 4 wt% of boric acid to have a total stretching ratio five times that of the original, and then the film was dried at 50°C for four minutes, and thus a polarizer of Comparative Example 2 was obtained. The 5 polarization degree of the polarizer of Comparative Example 2 at each wavelength of light for wavelength regions of 420 to 700 nm was in a range of 63.7 to 100%.

[0057]

(Comparative Example 3)

10 A polyvinyl alcohol film having a thickness of 75 µm was stretched to three times an original length in an aqueous solution dissolving potassium iodide and iodine at the weight ratio of 7 : 1, further stretched in an aqueous solution containing 4 wt% of boric acid to have a total stretching ratio five times that of the original, and then dipped in 10 wt% aqueous solution 15 containing potassium iodide for ten seconds and then the film was dried at 50°C for four minutes, and thus a polarizer of Comparative Example 3 was obtained. The polarization degree of the polarizer of Comparative Example 3 at each wavelength of light for wavelengths of 420 to 700 nm was in a range of 84.7 to 99.9%.

20 [0058]

The polarizers produced in Example 1 and Comparative Examples 1 to 3 were mounted on a thin film transistor (TFT) liquid crystal display. Chromaticities of white display and black display of a liquid crystal panel is measured as a chromaticity coordinate of CIE 1931 colorimetric system 25 (second degree viewing XYZ colorimetric system) by the use of a brightness photometer BM-5A chromaticity measurement device produced by Topcon Co., Ltd. Table 1 shows the results. Furthermore, Figure 1 is a chromaticity plot diagram of white display of liquid display panel. Figure 2 is a chromaticity plot diagram of black display of liquid display panel.

30 [0059]

[Table 1]

	white display		black display	
	x	y	x	y
Example 1	0.325	0.340	0.290	0.235
Comparative Example 1	0.324	0.339	0.220	0.219
Comparative Example 2	0.314	0.327	0.152	0.111
Comparative Example 3	0.329	0.342	0.458	0.336

[0060]

As is apparent from Table 1 and Figures 1 and 2, the hue of the white display is hardly changed and excellent in Example 1 and Comparative Examples 1 to 3. On the other hand, the chromaticity coordinate of the black display is blue in Comparative Examples 1 and 2 and red in Comparative Example 3, while the chromaticity coordinate of Example 1 is approximately neutral. It is confirmed that the hue the liquid crystal display in the present invention is improved.

[0061]

[Effect of the invention]

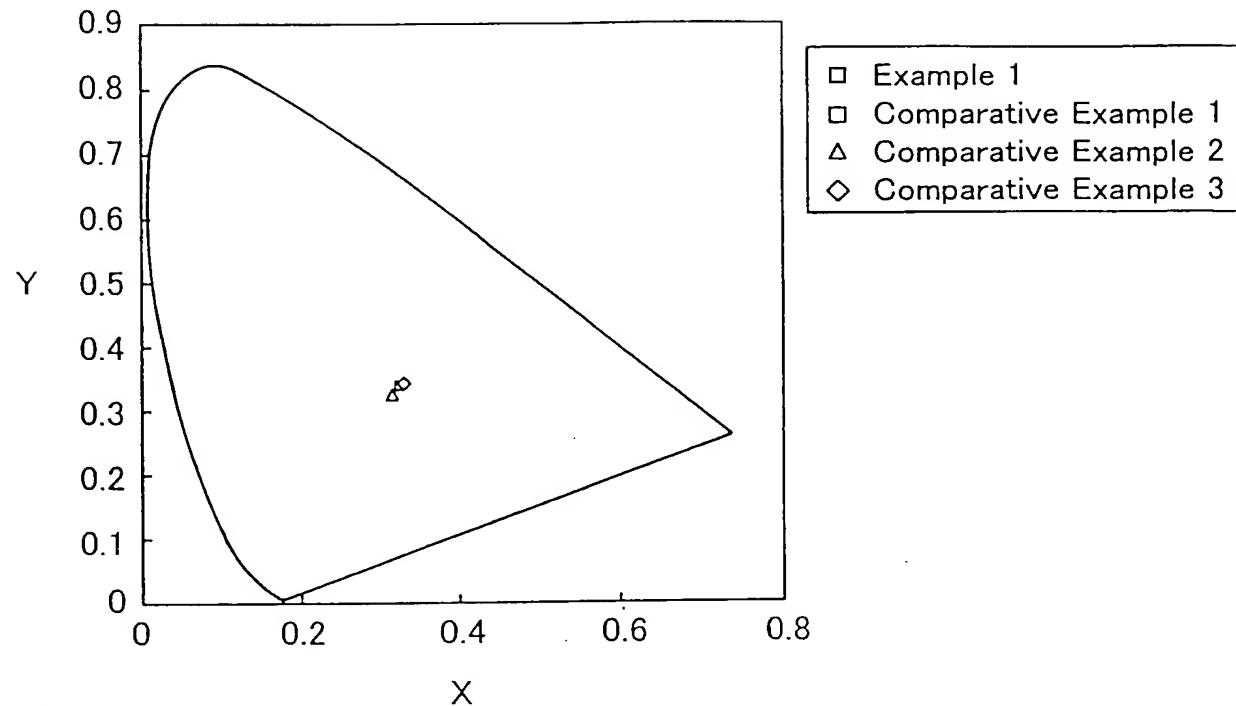
As mentioned above, the present invention can provide a polarizing plate excellent in the polarizing performance in all the wavelength regions from the short wavelength region to the long wavelength region by using the polarizer having a structure in which a portion having the polarization performance is high in the short wavelength region and a portion in which a the polarization performance is high in the long wavelength region are laminated. The industrial value is high.

[BRIEF DESCRIPTION OF THE DRAWINGS]

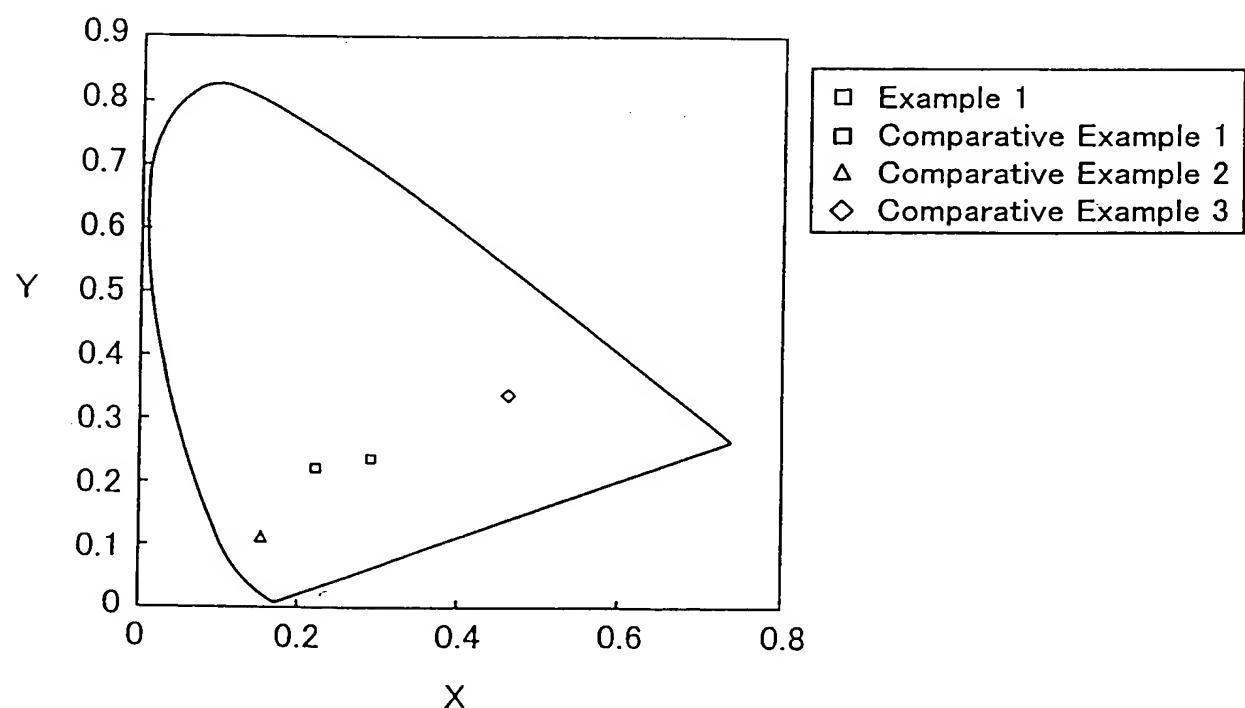
Figure 1 shows a chromaticity diagram of a white display of a liquid crystal display panel.

Figure 2 shows a chromaticity diagram of a black display of a liquid crystal display panel.

[Document Name] Drawings
[Fig. 1]



[Fig. 2]



[Document name] Abstract

[Abstract]

[Problem] To provide a polarizing plate excellent in polarization performance in all wavebands from a short wavelength region to a long wavelength region and a liquid crystal display using such a polarizing plate.

[Means for solving problem] The polarizing plate including a polarizer that has a portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 420 to 550 nm and a portion having a polarization degree of 99% or more at each wavelength of light for wavelengths of 550 to 700 nm.

[Selected Drawings] None